FIG. 3 is a graph showing a relation between an apparent thickness of the gate oxide film and a exposure period elapsed from the formation of the gate oxide film;

Please replace the paragraph of lines 4-14 of page 6 with the following:

This is because it is found that the apparent thickness of the oxide film measured by an optical instrument increases gradually after the oxide film is formed on the substrate. FIG. 3 shows a relation between a change in apparent thickness of the oxide film and a exposure period from the time immediately after the oxide film is formed to the time for measuring the thickness. As shown in the figure, the apparent thickness of the oxide film changes in accordance with the exposure period after the oxide film is formed. The longer the exposure period becomes, the larger the thickness of the oxide film becomes apparently. This phenomenon is considered as follows.

Please replace the paragraph of lines 4-11 of page 7 with the following:

Incidentally, after the surface of the oxide film was washed, the oxide film was exposed to the atmosphere for a specific period of time again, and the change in thickness of the oxide film was measured with respect to the new exposure period. Consequently, substantially the same experimental result as that shown in FIG. 3 was obtained. This result supports that water, carbon, and the like in the air are attached to the surface of the oxide film to apparently increase the thickness of the oxide film when the oxide film is exposed to the atmosphere.

Please replace the paragraph that begins on line 23 of page 7 and ends on line 5 of page 8 with the following:

For instance, an allowable thickness variation with respect to latitude (specification) for process control can be calculated to determine the period of time for measurement. The thickness variation in the process is calculated by a formula of:

$$\sqrt{S^2 + T^2} \leq U \qquad \text{.....(1)}$$

where S is a variation in thickness of the gate oxide film, T is a variation in thickness of the gate oxide film according to the exposure period and U is a specification latitude for the process control. The variation S is calculated at 3σ where σ represents standard deviation, as is generally well known in statistics. The variation S is produced when the gate oxide film is formed. The graph of Fig. 3 varies with every film, and the thickness variation T indicates the variation in thickness that occurs.

Please replace the paragraph of lines 17-23 of page 9 with the following:

As described above, when the gate oxide film 8 is exposed to the atmosphere after its formation, the relation between the apparent thickness of the gate oxide film and the exposure period of time is as shown in FIG. 3. An increase in the apparent thickness of the gate oxide film is represented by an approximate formula of:

$$y = a \cdot \ln(t) + b \qquad \text{.....(2)}$$

where $t > 1$, and the units of y are Å.

Please replace the paragraph beginning at line 24 of page 9 and ending at line 4 of page 10 with the following:

In the formula (2), "a" and "b" are constants, and "t" is an exposure period elapsed from the formation of the gate oxide film 8 to the measurement of the thickness. The constant a is determined by atmosphere (temperature, moisture) around a wafer disposed within a clean room, or the like, and was in a range of approximately 0.5 to 1.5 when it was measured in practice. The constant b is a thickness of the oxide film measured immediately after the gate oxide film 8 is formed (when t = 1 min).

Please replace the paragraph of lines 5-16 of page 10 with the following:

Incidentally, if the exposure period t was set to be zero in the formula (2), the thickness of the gate oxide film calculated by the formula (2) is 0 Å. This means that the gate oxide film 8 does not exist. Therefore, the exposure period t cannot be set to be less than 1 min when the thickness is measured immediately after the gate oxide film is formed. In practice, the initial thickness of the gate oxide film 8 is measured after the wafer is taken out of an apparatus for forming the oxide film 8. Because of this, approximately 1 min or more is required to measure the initial thickness of the gate oxide film 8 from the formation of the gate oxide film 8. Therefore, the approximate formula (2) meets the practical use.

Please replace the paragraph of lines 17-26 of page 10 with the following:

Accordingly, the apparent increase in thickness of the gate oxide film 8 is approximated by the formula (2), and calculated in accordance with the exposure period after the formation of the gate oxide film 8. The thickness of the gate oxide film can be corrected by subtracting the apparent increase in thickness from the measured apparent thickness of the gate oxide film. Thus, the exposure period is controlled after the gate oxide film 8 is formed, and the apparent thickness of the gate oxide film is corrected by the approximate formula (2). Consequently, the accurate thickness of the gate oxide can be detected.

Please replace the paragraph beginning at line 27 of page 10 and ending at line 9 of page 11 with the following:

FIG. 4 shows variations in thickness of the gate oxide film, quantified by the approximate formula (2) for reference. The result shown in FIG. 4 was obtained by leaving plural samples (samples A-J) for various periods of time, measuring the thickness of the gate oxide film in each sample by an ellipsometer, and correcting the measured result by the formula (2). In the figure, a broken line indicates the measured apparent thicknesses, and a solid line indicates the thicknesses of the gate oxide film after correction. Each exposure period for each sample is shown above each alphabetical reference.

Please replace the paragraph of lines 15-25 on page 13 with the following:

As shown in the figure, the gate oxide film, which is exposed to the atmosphere for a long period of time after its formation, has an apparently increased thickness, as compared to that immediately after the gate oxide film is formed (when exposure period is 49 min). As

opposed to this, the washing using the mixed solution of H_2SO_4 and H_2O_2 can return the measured thickness of the gate oxide film 8 to approximately its initial value at which the oxide film 8 was not exposed for a long period of time. The experimental results also reveal that the thickness of the gate oxide film 8 can be measured accurately by removing deposits from the surface of the gate oxide film 8 immediately before the thickness is measured.

Please replace the paragraph of lines 8-14 on page 14 with the following:

Thus, according to the present embodiment, the thickness of the gate oxide film can be measured accurately without being affected by deposits, by removing the deposits from the surface of the gate oxide film 8. In addition, in the present embodiment, even when the exposure period of the wafer before washing is not known, the thickness of the gate oxide film can be measured accurately by controlling the exposure period after washing.

Please replace the paragraph that begins on line 21 of page 15 and ends on line 3 of page 16 with the following:

In the embodiments described above, the thickness of the gate oxide film is in a range of approximately 90Å to 110Å. However, the present invention is especially effective when the thickness of the gate oxide film is less than approximately 100Å. The thinner the oxide film is, the more the rate of variation in change of the thickness is prominent. Therefore, in such a case, the thickness control according to the present invention is very effective to measure the real thickness precisely. It is apparent that the present invention can be applied to a gate oxide film that is more than 100Å in thickness as well.

Please replace the paragraph that begins on line 2 of page 24 and ends on line 6 of page 24 (the abstract) with the following:

In a process of manufacturing a semiconductor device, after a gate oxide film is formed, the thickness of the gate oxide film is measured by measuring an exposure period defined from a time at which the oxide film is formed to a time at which the thickness of the oxide film is measured. In addition, if necessary, the measurement of the oxide film is corrected to determine the real thickness based on the exposure period. Accordingly, the thickness of the gate oxide film can be measured accurately.

IN THE CLAIMS

Please cancel claims 8 and 19 without prejudice.

Please replace claims 1-5, 9-16, and 20-22 with the following:

1. (Amended) A method for measuring the thickness of an oxide film, comprising:

forming an oxide film on a substrate;

measuring an exposure period from a time at which the oxide film is formed to a time at which the thickness of the oxide film is measured; and